PHYSICAL SCIENCE DSHS
Name___________________________ Mrs. Ellis

Worksheet for PSSC's Classic Film: Frames of Reference

1. All motion is ___________, but we tend to think of one thing as being fixed and the other thing as being moving. We usually think of the ____________ as being fixed.

2. A frame of reference fixed to the _________ is the most common __________________ in which to observe the motion of other things. The position of any object can be specified using _____________ reference lines.

3. When the steel ball drops on the constant velocity cart, it follows a ____________ path in the frame of reference fixed to the ___________, but a _____________ straight line in the frame of reference of the constant velocity cart.

4. Without a fixed reference frame, one cannot tell whether or not you are in a _______________ frame of reference. All frames of reference moving at constant velocity with respect to one another are_____________.

5. The white spot follows a ___________ path in the frame of reference of the _________. In the frame of reference of the _________ it follows a more complicated path. When the motion is ___________ from the moving frame we automatically put ourselves in that moving frame.

6. The _____________ states that an object moves at a constant velocity unless an unbalanced force acts on it. The first time the dry ice puck is made to move it appears to travel at the same speed in each direction because the experiment is being viewed from the frame of reference of the _____________. When the experiment is viewed in the Earth's frame of reference, the puck appears to travel faster when it is traveling to the ___________ (right, left).

7. When the steel ball drops on the ____________ cart, it follows a path off to one side of the vertical reference line of the pole. If you were in the reference frame of the accelerating cart, you _______________(would not be able to, would be able to) identify the force pushing sideways on the ball, even though the Law of Inertia requires it. The only force you can identify as acting on the falling ball is _____________ so, it should fall straight down.

8. If the Law of Inertia is to hold, there must be a force acting to the ___________ (left, right) on the ball to cause it to deviate from the vertical path. The force _________ (can be, can't be) identified as a ____________ (magnetic, electric, nuclear) force. You must conclude that the law of inertia _________________ (does, does not) hold in the frame of reference of the _________________.

9. Because the frame of reference that we are used to living in is one in which the _______________ holds, when we go into a ________________ like the frame of the accelerated cart, our belief in the Law of Inertia is so strong that when we see an __________ of the ball sideways we think there is a force causing it, so we make up a fiction that there is a force and sometimes we call this a fictitious force.

10.___________ arise in accelerated frames of reference. The frame of the cart in the experiment was accelerated to the ___________ (right, left) and you in the frame of the cart saw the ball accelerated to the __________ (right, left) and you say that it is caused by a ___________.

11. An inertial frame of reference is one in which ____________ is valid. All frames of reference moving at a _____________ with respect to an inertial frame are also inertial frames. We use the _________ as an inertial frame of reference, but it is only approximately one. It has a small acceleration with respect to the ________.

12. The frame of reference of the __________ is the best we can do when we look for a frame of reference which is for all practical purposes fixed. An ___________ frame of reference is not an inertial frame. When we are in an _________ frame we have to introduce forces which we call ___________ forces in order that the Law of Inertia and the other laws of physics don’t change.

Review questions... how well did you listen to the video?

Think about each scenario and answer accordingly.

1. You are in the back seat of a car moving in a straight line at a constant speed. You toss a tennis ball straight up. Where does it land?

   In your hand *in front of you* *behind you*

2. You toss the tennis ball straight up again. While it is in the air, the car accelerates forward. Where does the ball land?

   In your hand *in front of you* *behind you*

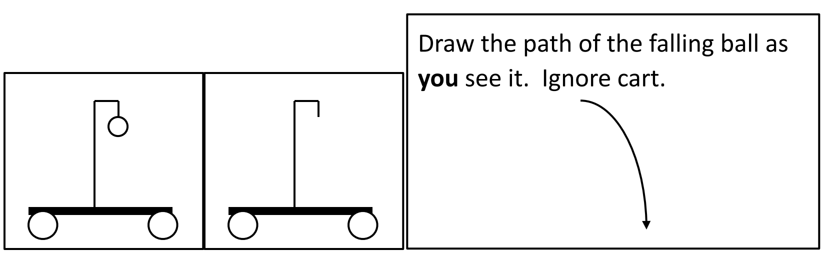
3. You toss it again. While it is in the air, the car slams on its brakes. Where does the ball land?

   In your hand *in front of you* *behind you*

For the following, draw the ball/cart after the ball drop and the path YOU would see for the falling ball for each of the following scenarios. Use the cart and vertical rod as reference points in your diagrams.

As seen in the video, a steel ball is attached to the top of a vertical bar by an electromagnet which drops the ball in front of you.

4. You are stationary. You observe the cart and ball moving sideways to you at **constant velocity** when the ball falls.



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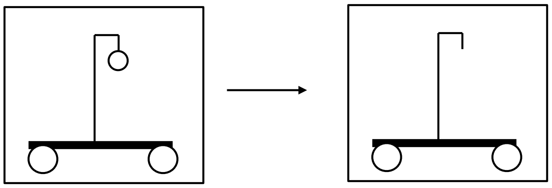
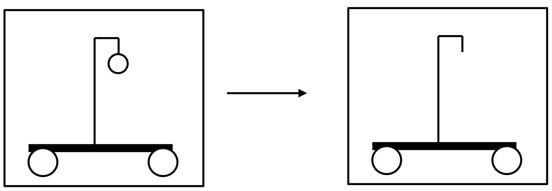
5. You are stationary. You observe the cart and ball moving sideways to you as they **accelerate** forward when the ball falls.



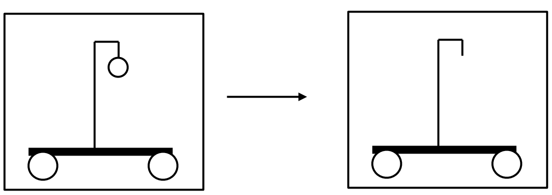
Draw the path of the falling ball as **you** see it. Ignore cart.

6. You are on the cart, moving with **constant velocity** along with the ball and cart when the ball falls.



Draw the path of the falling ball as **you** see it. Ignore cart.

7. You are on the cart, accelerating along with the cart and the ball when the ball falls.



Draw the path of the falling ball as **you** see it. Ignore cart.

8. In which of the above scenarios are you tempted to introduce a fictitious force to explain the motion of the ball? Where does that fictitious force have to be applied to make the motion you see?